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Applicant : Natkin et al.

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Examiner : Truc T. Chuong

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Title : TRACKING THE VALIDITY OF CACHE FRAMES IN DIGITAL MOVIE EDITING

Mail Stop Appeal Brief - Patents

Commissioner for Patents

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BRIEF ON APPEAL**(1) Real Party in Interest**

The real party in interest is Adobe Systems Incorporated, by virtue of an assignment from the inventors recorded in the U.S. Patent Office on January 8, 2001, Reel 011415, Frame 0963.

(2) Related Appeals and Interferences

There are no related appeals or interferences known to the appellant.

(3) Status of Claims

Claims 1-50 are pending. Claims 1, 5 and 28 are independent claims. Claims 4, 15, 21, 38, and 44 have been allowed. Claims 1-3, 5-14, 16-20, 22-37, 39-43, and 45-50 stand rejected under 35 U.S.C. Section 102(b) as being anticipated by U.S. Patent No. 5,801,685 to Miller et al. ("Miller"). Claims 9, 10, 32, and 33 stand rejected under 35 U.S.C. Section 112, second paragraph as being indefinite.

(4) Status of Amendments

There are no unentered amendments.

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June 14, 2004

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(5) Summary of Invention

The invention relates to compositing and, in one implementation, provides a feature that determines, base on edit sequence information, whether a cached frame of a movie composition is valid.

Compositing is the process of reading input elements, for example, still and moving image and graphics files, applying masking, geometric transformations and arbitrary effects, any of which may vary over time, and layering these images together to produce a composition. The composition includes one or more output images, usually referred to as output frames or simply frames. The composition is usually defined by a compositing tree, which, *inter alia*, identifies the elements of the composition and specifies their hierarchal relationships. The compositing tree usually includes multiple nodes, each of which can represent one or more elements. One application of compositing is movie making, in which case the composition typically includes animation and is referred to as a movie composition. To render the movie composition, the frames are rendered from one or more elements in accordance with the compositing tree of the movie composition. The rendered frames are then output in their sequential order. The movie composition has a master timeline in which the frames are displayed. An element of the movie composition can have its own timeline, which maps to the master timeline. (*See Specification*, at p. 1, line 1 – p. 2, line 4.)

Frames of a movie composition are often cached because it is usually computationally expensive to render a frame. If a cached frame is outdated because, for example, it contains data that has been edited since the frame was cached, then the cached frame is invalid and usually cannot be used. Re-rendering would usually be necessary in this case. If, however, the cached frame is up to date, then the cached frame is usually valid and, hence, can be displayed. Re-rendering, in this case, is not necessary. (*See id.*, at p. 2, line 7 – p. 3, line 2.)

To facilitate the validity determination, a system implemented in accordance with the invention tracks the sequence of edits made to the movie composition. The system associates, with each interval of an element's timeline, information that indicate the edit sequence position, in the sequence of edits made to the movie composition, of a most recent edit that affected the element during the interval. A most recent edit that affected the element during the interval may not be the most recent edit made to the movie composition that affected the element. Given, for

example, ten edits made to the movie composition, the fifth edit being the most recent edit that affected the element during the interval, and the ninth edit being the most recent edit made that affected the element, but not during the interval. In this case, the fifth edit sequence position and not the ninth edit sequence position would be associated with the interval of the element's timeline. (*See id.*, at p. 4, line 27 – p. 7, line 19.)

When a frame is cached, the system associates with the frame being cached a most recent edit sequence position associated with the input elements used to render the frame. The edit sequence position associated with the cached frame is one that represents a state of editing of the movie composition at the time the frame is cached. To determine the validity of the cached frame, the system compares the edit sequence position associated with the cached frame with the edit sequence positions currently associated with the elements that are specified by the current compositing tree to be input elements for the frame. If the edit sequence position associated with the cached frame is the same or subsequent to the edit sequence positions associated with the input elements, then the cached frame is valid. Otherwise, the cached frame is invalid. (*See id.*, at p. 5, lines 1-5; p. 8, lines 11-14.)

In one implementation, the system stores information indicating edit sequence positions in an interval list, instances of which are attached to nodes of the compositing tree. The interval list indicates for each interval of an element of the movie composition, a position of the most recent edit that affects the element during the interval. The movie composition usually includes multiple interval lists for each of its nodes. Notably, an interval list is different than a master timeline. The master timeline indicates when a frame is displayed but cannot indicate when elements used to render the frame was edited. In contrast, the interval list can indicate, *inter alia*, when the elements used to render the frame was edited. (*See id.*, at p. 5, line 14 – p. 6, line 18.)

(6) Issues

1. Are claims 1-3, 5-14, 16-20, 22-37, 39-43, and 45-50 properly rejected under 35 U.S.C. Section 102(b) as being anticipated by Miller?

2. Are claims 9, 10, 32, and 33 properly rejected under 35 U.S.C. Section 112, second paragraph as being indefinite?

(7) Grouping of Claims

For the purpose of this appeal, the claims are grouped as follows:

1. For the purpose of issue 1, the claims do not stand and fall together, except as indicated below.

Group 1. Claims 5-8, 12, 13, 25, 27-31, 35, 36, 48, and 50 stand and fall together.

Group 2. Claims 1-3 stand and fall together.

Group 3. Claims 9-11 and 32-34 stand and fall together.

Group 4. Claims 14, 22, 37, and 45 stand and fall together.

Group 5. Claims 16-20 and 39-43 stand and fall together.

Group 6. Claims 23, 24, 46, and 47 stand and fall together.

Group 7. Claims 26 and 49 stand and fall together.

2. For the purpose of issue 2, claims 9, 10, 32, and 33 stand and fall together.

(8) Argument

1. Are claims 1-3, 5-14, 16-20, 22-37, 39-43, and 45-50 properly rejected under 35 U.S.C. § 102(b) as being anticipated by Miller?

(A) Group 1 (Claims 5-8, 12, 13, 25, 27-31, 35, 36, 48, and 50)

Claim 5 recites:

“associate edit sequence information with an element of the movie composition, the edit sequence information specifying, for an interval of the element’s timeline, an edit sequence position representing the position in a sequence of edits made to the movie composition of a most recent edit made that affects the element during the interval, the interval being a portion of the timeline;

when caching a frame, associate with the cached frame an edit sequence position that represents a state of editing of the movie composition; and

when displaying the frame, compare the edit sequence position associated with the cached frame with edit sequence information associated with the element,”

which are the first, second, and third elements, respectively, of the claim. The Examiner contends that Miller discloses all of the above cited elements. The applicant must respectfully disagree because Miller, in fact, discloses none of these elements, as will be established below.

(A)(i) Miller does not even contemplate edit sequence information, which is required by the first element of claim 5

The first element of claim 5 requires edit sequence information that specifies, for an interval of an element's timeline, an edit sequence position of a most recent edit made that affects the element during the interval. An edit, by its plain meaning, refers to a change. Thus, the first element of claim 5 requires that the edit sequence information specifies, for an interval of an element's timeline, an edit sequence position of a most recent change made that affects the element during the interval.

Miller, at column 6, lines 28-38, states: "The editing timeline preferably illustrates the start time of each video clip edit in the EDL with respect to each other." The Examiner contends that this statement discloses the first element of claim 1 and, thus, the above-discussed requirement of claim 5. The applicant must respectfully disagree for reasons set forth below.

As it is used in Miller, the term "edit" does not have the ordinary meaning of change, and the terms "the start time of each video clip edit in the EDL with respect to each other" consequently refers to points in time when video clips are played and not points in time when changes are made to the video clips, as would be required to disclose the first element of claim 5. In particular, Miller explains that an EDL, or an edit decision list, is a list that specifies video clips selected for inclusion in a video segment. The EDL also indicates the video clips' start time (indicating when a video clip is to be played) and the duration (indicating how long the video clip is played). The times included in the EDL are thus start times and duration, and the sequence indicated by the EDL is the sequence in which the video clips are played and not the sequence in which edits were made to the video clips. (*See Miller*, at col. 1, lines 22-42.)

Miller provides an example of how the EDL is implemented. Miller explains that an editor can create a video segment that can be broadcast in coordination with a script that is read by a news announcer. To create the video segment, the editor selects video clips and arranges them into a video segment. The editor notes in the EDL the identification of the selected video

clips, their locations, start times, and duration. A technician can use the EDL to compile the video segment. In particular, the technician copies the selected video clips, from their respective locations and in the order and run time specified by the EDL, onto video tape or some other medium for on-air broadcast. At air time, the video segment (consisting of the video clips) is replayed while the news announcer reads the story script. (*See id.*)

Miller further explains that an "edit in the EDL" refers to a video clip. See, for example, lines 37-38 of column 6, which reads: "The selected video clip is automatically entered as an *edit in the EDL*." (Emphasis added.) See, also, lines 3-9 of column 15, which reads: "Each entry in the EDL specifies a video source material clip. Each entry in the EDL may be referred to as an '*edit*'" (Emphasis added.)

In view of Miller's description of an EDL and explicit definition that an edit in the EDL refers to a selected video clip, Miller's statement that the "editing timeline preferably illustrates the start time of each video clip edit in the EDL with respect to each other" refers to start times that indicate when video clips are to be played and not start times that indicate when edits were made, as required by the first element of claim 5.

Miller neither contemplates nor discloses that the EDL includes times that indicate when changes were made to video clips. Indeed, one cannot use Miller's EDL to determine the sequence in which edits were made to the video clips or even which of the selected video clips was last edited. FIG. 3 of Miller, for example, shows Miller's editing timeline (item 150), which is a graphical representation of its EDL. As can be seen, the editing timeline indicates when each video clip of the video segment is played. In this example, there are two video clips. A first video clip labeled as "Wide shot of church in flames" is scheduled to be played before a second video clip labeled as "Flames through window" is played. In particular, the first video clip is scheduled to be played while the portion of the script delimited by the control symbols |1| and |2| is being read, and the second video clip is scheduled to be played while the portion of the script delimited by the symbol |2| and the end of the script is being read. There is no information in the editing timeline that indicates when edits were made. One cannot determine from the editing timeline shown, for example, which of the two video clip was first entered in the EDL, or which was last edited.

For at least the above reasons, the start times in Miller's EDL do not disclosed the applicant's claimed edit sequence information, which specifies, for an interval of the element's timeline, an edit sequence position representing the position in a sequence of edits made to the movie composition of a most recent edit made that affects the element during the interval. Miller's start times merely indicate the start times and duration of the video clips selected to be included in the video segment. Miller, thus, does not disclose the first element of claim 5. Accordingly, claim 5 and claims 6-13, 25, and 27, which depend from claim 5 are improperly rejected.

Moreover, even assuming *arguendo* that start times in Miller's EDL disclose edit sequence information, Miller still does not disclose the first element of claim 5. Specifically, the first element of claim 5 requires that the edit sequence position represents the position, in a sequence of edits made to the movie composition, of a most recent edit made that affects the element *during an interval that is a portion of the element's timeline*. Such edit sequence position thus can represent the state of editing of the element with a level of specificity that is finer than the element's entire timeline (i.e., the entire run time of the video clip). Miller does not contemplate such a level of specificity. There is simply no description in Miller that the start times in the editing timeline applies to only a portion of the video clip. For at least this reason, Miller, even assuming *arguendo* that the terms at issue refer to the sequence of edits made to video clips of the video segment, still fails to disclose the first element of claim 5. Accordingly, claim 5 and claims 6-8, 12, 13, 25, and 27, which depend from claim 5, are improperly rejected.

(A)(ii) Miller's process does not associate with a frame, when the frame is cached, an edit sequence position that represents a state of editing of the movie composition, which is required by the second element of claim 5

The Examiner contends that Miller, at lines 18-42 of column 5 and lines 28-37 of column 6, discloses the second element of claim 5. The applicant must disagree for reasons set forth below.

Lines 18-42 of column 5 describe a process in which the EDL is automatically updated in response to changes to the script. The update is effected by scanning the script for link control sequences, which are symbols embedded in the script to identify a video clip associated with the

portion of text marked by the symbols. When a link control sequence is encountered, the current reading time is calculated. The current reading time is the time that a news announcer requires to read the portion of the script preceding the link control sequence. The calculated current reading time is then compared to the start time of the video clip, stored in an edit link table used to relate link control sequences to video clips and their respective start times. If they are different, then the start time of the video clip is updated to match the calculated current reading time. The calculated current reading time, notably, has nothing to do with edit sequence information and in no way indicates when an edit was made to the video clip.

For reasons discussed above, Miller does not contemplate edit sequence position. Thus, Miller's EDL update process cannot disclose associating an edit sequence position with a cached frame. For at least this reason, Miller does not disclose the second of claim 5. Accordingly, claim 5 and claims 6-8, 12, 13, 25, and 27, which depend from claim 5 are improperly rejected.

Moreover, even assuming *arguendo* that the start times in the EDL indicate edit sequence information, Miller's automatic update process still fails to disclose the second element of claim 5 because the update process is independent of any frame caching. Specifically, there is no disclosure in Miller that its update process occurs when a frame is cached, which is required to disclose the second element of claim 5. Indeed, Miller does not contemplate frame caching. Furthermore, it appears that Miller's update process occurs after the video clips have been stored in the video clip database and before a technician copies the video clips onto the on air broadcast medium. So, even if one were to broadly construe frame caching to be merely frame storing, a point the applicant does not concede, Miller's update process still fails to disclose the second element of claim 5 because no frames are being stored during Miller's update process.

Lines 28-37 at column 6 describes Miller's editing timeline. As discussed above, Miller EDL does not disclose the applicant's claimed edit sequence information. Thus, Miller's editing timeline, which is but a graphical representation of Miller's EDL, also does not disclose the applicant's claimed edit sequence information. Accordingly, Miller's editing timeline cannot disclose, when caching a frame, associating with the cached frame an edit sequence position that represents a state of editing of the movie composition, as required by the second element of claim 5.

For at least the above reasons, Miller does not disclose the second element of claim 5. Accordingly, claim 5 and claims 6-8, 12, 13, 25, and 27, which depend from claim 5 are improperly rejected.

(A)(iii) Miller's process does not compare the edit sequence position associated with the frame with the edit sequence information associated with the element, which is required by the third element of claim 5

The Examiner contends that Miller, at lines 26-50 of column 5 and lines 28-37 of column 6, discloses the third element of claim 5. The applicant must disagree for reasons set forth below.

As discussed above, these portions of Miller describe Miller's EDL update process and editing timeline, and do not disclose edit sequence information or frame caching. Thus, Miller cannot disclose comparing the edit sequence position associated with a cached frame with the edit sequence information associated with the element, as required by the third element of claim 5. For at least this reason, Miller does not disclose the third element of claim 5. Accordingly, claim 5 and claims 6-8, 12, 13, 25, and 27, which depend from claim 5 are improperly rejected.

Even assuming *arguendo* that the start times in the EDL indicates the sequence of edits made to the video clips and that Miller discloses frame caching, the cited portion of Miller still fails to disclose the second element of claim 5. In Miller's EDL update process, the times being compared are the current reading time, i.e., the time a news announcer needs to read the preceding portion of the script, and the start time of the video clip. This comparison is different than and, hence, does not disclose a comparison of the edit sequence position associated with the frame and the edit sequence information associated with the element, as required by the third element of claim 5. For at least this reasons, Miller does not disclose the third element of claim 5. Accordingly, claim 5 and claims 6-13, 25, and 27, which depend from claim 5 are improperly rejected.

Moreover, assuming *arguendo* that the start times in the EDL indicates the sequence of edits made to the video clips, that Miller discloses frame caching, and that the calculated current reading time somehow indicates the edit sequence position of the cached frame, Miller still fails

to disclose the third element of claim 5. In particular, the third element of claim 5 requires that the comparison be made when the cached frame is displayed. The process described by the cited portion of Miller, as discussed above, is one that updates the EDL in response to changes in the script and, furthermore, occurs independently of any frame displaying process. There is simply no disclosure in Miller that the comparison of the current reading time and the start time occurs when the cached frame is displayed. For at least this reason, Miller does not disclose the third element of claim 5. Accordingly, claim 5 and claims 6-13, 25, and 27, which depend from claim 5, are improperly rejected.

(A)(iv) Claims 28-31, 35, 36, 48, and 50 are improperly rejected for reasons similar to those discussed in Sections A(i)-A(iii)

Claim 28 recites:

“associating edit sequence information with an element of the movie composition, the edit sequence information specifying, for an interval of the element’s timeline, an edit sequence position representing the position in a sequence of edits made to the movie composition of a most recent edit made that affects the element during the interval, the interval being a portion of the timeline;
when caching a frame, associating with the cached frame an edit sequence position that represents a state of editing of the movie composition; and
when displaying the frame, comparing the edit sequence position associated with the cached frame with edit sequence information associated with the element.”

These elements are similar to those of claim 5 and the applicant respectfully submits that, for at least the above reasons, Miller does not disclose the elements of claim 28. Accordingly, the applicant respectfully submits that claim 28 and claims 29-31, 35, 36, 48, and 50, which depend from claim 28, are improperly rejected.

(B) Group 2 (Claims 1-3)

Claims 1-3 are separately patentable because they recite, in addition to features recited by the claims of group 1, the feature of an interval list. The interval list provides a data structure

that can compactly and efficiently store cached-frame information. (See Specification, at p. 3, lines 28 and 29.)

Claim 1 recites:

maintain a global editing timestamp that is updated with each editing operation performed by the system, the global editing timestamp representing an edit sequence position in a sequence of edits made to the movie;

establish an interval list for each node in a compositing tree defining a movie, each node having a timeline that maps to a master timeline of the movie, an interval list for a node including, for each interval in the node's timeline, a single editing timestamp;

update the interval list for a node when the node is edited; and

use the interval list for a first node to evaluate the validity of a cached frame for a particular interval of the master timeline, the cached frame having been produced by compositing the first node in the compositing tree, the evaluation being performed by (a) comparing (i) an editing timestamp associated with the cached frame with (ii) the editing timestamps of intervals in the interval list that map to at least a portion of the interval of the master timeline, and (b) treating the cached frame as invalid if any of the intervals' editing timestamps is later than the editing timestamp associated with the cached frame.

which are the first, second, third, and fourth elements, respectively, of the claim. The Examiner contends that Miller discloses all of the above cited elements. The applicant must respectfully disagree because Miller, in fact, discloses none of these elements, as will be established below.

(B)(i) Miller does not even contemplate edit sequence position, which is required by the first element of claim 1

The first element of claim 1 requires the maintaining of a global editing timestamp that is updated with each editing operation performed by the system. The global editing timestamp represents an edit sequence position in a sequence of edits made to the movie.

The Examiner relies on lines 28-38 of column 6 of Miller to assert that Miller discloses the applicant's claimed timestamp. As discuss above, Miller does not contemplate edit sequence

position and, hence, cannot disclose the first element of claim 1. For at least this reason, claim 1 and claims 2 and 3, which depend from claim 1, are improperly rejected.

Moreover, the first element of claim 1 requires that the global editing timestamp be updated for each editing operation performed by the system. This is not the case with Miller's system. An edit to the script that does not change the start time of any linked video clips, for example, would not result in an update in any of the start times in Miller's editing timeline. So, even assuming *arguendo* that Miller's start times indicate edit sequence information, Miller still does not disclose the first element of claim 1 because its start times are not updated for each editing operation performed by the system, as required by the first element of claim 1. For at least this reason, claim 1 and claims 2 and 3, which depend from claim 1, are improperly rejected.

(B)(ii) Miller does not disclose the claimed interval list, which is required by the second element of claim 1

The claimed interval list includes an editing timestamp, which the applicant has defined in the specification to include an indication of an edit sequence position. The Examiner relies on lines 54-67 of column 18 to assert that Miller discloses the second element of claim 1. The cited portion describes Miller's editing timeline, which, as discussed above, does not disclose edit sequence information or edit sequence position. Miller thus does not disclose the claimed interval list because Miller does not disclose edit sequence information or position. For at least this reason, claim 1 and claims 2 and 3, which depend from claim 1, are improperly rejected.

Moreover, the second element of claim 1 requires an interval list be established for each node in a compositing tree. The applicant specifies in the specification that a compositing tree includes a root that is a comp, the comp being composed of one or more layers. Miller simply includes no description of such a compositing tree. The Examiner contends that Miller's database listing of video clips discloses the compositing tree. However, the database listing is simply a list of video clips available for selection. Miller does not disclose that this listing includes information that describes relationships between or among the listed video clips. A compositing tree, in contrast, would typically include such indications for its nodes. Thus, Miller's listing does not disclosed the recited compositing tree, and Miller cannot disclose an interval list for

each node of such a compositing tree. For at least this reason, claim 1 and claims 2 and 3, which depend from claim 1, are improperly rejected.

(B)(iii) Miller does not disclose updating the interval list for a node when the node is edited

As discussed above, Miller does not disclose the claimed interval list. Thus, Miller cannot disclose updating such a list. Accordingly, Miller does not disclose the third element of claim 1. For at least this reason, claim 1 and claims 2 and 3, which depend from claim 1, are improperly rejected.

Moreover, even assuming *arguendo* that Miller's video clips are nodes in a compositing tree, that Miller's editing timeline is an interval list, and that an editing timeline is established for each of these node, Miller still does not disclose the third element of claim 1. Specifically, the third element of claim 1 requires that the interval list for a node be updated when the node is edited. To disclose this feature, Miller must disclose or at least suggest that its editing timeline is updated when edits are made to the video clips, which is not the case. Miller is silent on what happens when edits are made to the video clips, for example, a changing of the color of an object shown in the video clip. Thus, Miller does not disclose the third element of claim 1. For at least this reason, claim 1 and claims 2 and 3, which depend from claim 1, were improperly rejected.

(B)(iv) Miller does not disclose the fourth element of claim 1

The fourth element of claim 1 requires that the interval list be used to evaluate the validity of a cached frame. The evaluation is performed by comparing (i) an editing timestamp, which represent edit sequence position, associated with the cached frame with (ii) the editing timestamps in the interval list. The cached frame is treated as invalid if any of the intervals' editing timestamps is later than the editing timestamp associated with the cached frame. As discussed above, Miller does not disclose edit sequence information, cached frames, or interval lists, as they are recited by claim 1. Furthermore, as also discussed above, Miller's comparing of the calculated current reading time with the start time of a video clip does not disclose a comparison of edit sequence positions. For at least these reasons, claim 1 and claims 2 and 3, which depend from claim 1, are improperly rejected.

Moreover, Miller is silent on the notion of invalidating a frame. The Examiner contends that Miller's EDL update process discloses this feature. However, in the event that the EDL process detects a discrepancy between the calculated current reading time and the start time, the later is simply updated. No frames are treated as invalid. Thus, Miller's EDL update process does not disclose the fourth element of claim 1. For at least this reason, claim 1 and claims 2 and 3, which depend from claim 1, were improperly rejected.

(C) Group 3 (Claims 9-11 and 32-34)

Claims 9-11 and 32-34 are separately patentable because they recite, in addition to features recited by the claims of groups 1 and 2, the additional feature of identifying the interval of the elements time line that is affected by an edit. A system implementing this feature can determine the validity of cached frames based on nodes and time. (*See Specification, at p. 3, lines 26-28.*)

Claim 9 recites "for an edit made to the movie composition, identify an interval of the element's corresponding timeline that may be affected by the edit." As can be seen, claim 9 requires, for an edit made to the movie composition, an identification of an interval of the element's timeline affected by the edit, which allows one to evaluate the validity of a frame on not only a node basis but also a time basis. The Examiner contends that column 13 discloses claim 9. The applicant must respectfully disagree for the reasons set forth below.

Claim 9 depends from claim 5 and are improperly rejected for reasons similar to those discussed with respect to claim 5. Moreover, column 13 describes the process of linking video clips to a script. In this process, the changes to the EDL and the editing timeline are considered, and the intervals identified are interval in the timeline of the video segment. However, no consideration is given to the timeline of the video clip, or to any interval of such a timeline, which would be required to anticipate claim 9. For at least the above reasons, claim 9 is improperly rejected.

For reasons similar to those discussed with respect to claim 9, claims 10, 11, and 32-34 are improperly rejected.

(D) Group 4 (claims 14, 22, 37, and 45)

Claims 14, 22, 37, and 45 are separately patentable because they recite, in addition to features recited by the claims of groups 1, 2, and 3, the feature of having the edit sequence information include an interval list, the interval list specifying, for each interval of the element's timeline, the edit sequence position representing a position in a sequence of edits made to the composition of a most recent edit made that affects the element during the interval. A system implementing this feature can efficiently evaluate the validity of individual cached frames of a node and need not invalidate all frames of a node when an edit affects only some of the frames of the node. (See Specification, at p. 6, line 23 - p. 7, line 19.)

Claims 14 and 22 and claims 37 and 45 depend from claim 5 and claim 28, respectively, and are thus improperly rejected for the reasons discussed above with respect to claim 5 and claim 28.

Claims 14, 22, 37, and 45 include elements similar to the interval list recited in claim 1. For reasons similar to those discussed with respect to the interval list of claim 1, claims 14, 22, 37, and 45 are improperly rejected.

Moreover, claims 14, 22, 37, and 45 require that the interval list specifies, for each interval in the element's timeline, the edit sequence position representing a position of a most recent edit made that affects the element during the interval. The Examiner asserts that Miller, at lines 14-56 of column 11, discloses the claimed interval list. The Examiner seems to suggest that the EDL discloses the interval list. However, while the EDL may include intervals, these intervals are intervals in the timeline of the entire video segment (which includes all the selected video clips), and are not intervals in the timeline of a video clip (i.e., an element of the video segment), which is required to anticipate the applicant's claimed interval list. Moreover, Miller simply does not contemplate the most recent edit made that affects the element, which is also required to disclose the applicant's claimed interval list. Accordingly, the Miller's EDL does not disclose claims 14, 22, 37, or 45. These claims are thus improperly rejected.

(E) Group 5 (Claims 16-20 and 39-43)

Claims 16-20 and 39-43 are separately patentable because they incorporate from claims 15 and 38, respectively, the additional feature of having each interval of the interval list, except

for the last interval of the list, be delimited by its start time and the start time of the subsequent interval. This features compactly stores the edit sequence information. (*See Specification*, at p. 3, lines 28 and 29.)

The Examiner rejected claims 16-20 and 39-43 as being anticipated by Miller. However, the Examiner has stated that claims 15 and 39 would be allowable if rewritten to have independent form. Claims 16-20 and claims 39-43 depend from claim 15 and claim 38, respectively, and, thus, are allowable for at least reasons why claims 15 and 38 are allowable. Accordingly, claims 16-20 and 39-43 are improperly rejected. Moreover, claims 16-20 and claims 39-43 depend from claim 5 and claim 28, respectively, and are improperly rejected for at least the reasons why claims 5 and 28 are improperly rejected.

(F) Group 6 (Claims 23, 24, 46, and 47)

Claims 23, 24, 46, and 47 are separately patentable because they recite, in addition to features recited by the claims of groups 1-5, the feature of maintaining a first interval list for a first type of edit and a second interval list for a second type of edit. Separate interval lists help to distinguish those edits that affect this per-frame cache from those that affect the transformation, thus allowing the system to re-render the transformation and the comp but not the layer's effects. (*See Specification*, at p. 9, lines 23-26.)

The Examiner contends that FIG. 2 of Miller inherent discloses the feature of having different interval list for different types of edits. The applicant respectfully disagrees for the reasons set forth below.

FIG. 2 shows Miller's system, which includes an editing server, multiple sources of video clips, and multiple computers. There is simply nothing in FIG. 2 that inherently discloses that there are different interval lists for different types of edit, as required by claims 23, 24, 46, and 47. For at least this reason, claims 23, 24, 46, and 47 are improperly rejected.

Moreover, claims 23 and 24 and claims 46 and 47 depend from claim 5 and claim 28, respectively, and are improperly rejected for reasons why claims 5 and 28 are improperly rejected.

(G) Group 7 (Claims 26 and 49)

Claims 26 and 49 are separately patentable because they recite, in addition to features recited by the claims of groups 1-6, the additional feature of considering collateral dependencies between or among elements of a composition in determining the validity of a cached frame. The applicant's specification explains that if an expression on some layer looks up another layer by name and uses its parameters, changing the name may in fact affect the output pixels. In one implementation, these dependent expressions or "collateral dependencies" are essentially pointers to parameters. (*See Specification, at p. 5, lines 10-14.*)

The Examiner contends that Miller, at col. 5, lines 25-65, col. 16, lines 25-67, col. 17, lines 45-67, and col. 8, lines 54-67, anticipates claims 26 and 49. The applicant respectfully disagrees. The cited portions of Miller describe Miller's EDL update process and editing server. As discussed above, the EDL update process updates the start times of video clips when the script has been changed and synchronization is lost. The dependencies disclosed are between Miller's script and the video clips and, notably, not between or among the video clips themselves. There is simply nothing in these portions of Miller that contemplates collateral dependencies between or among the video clips that make up a video segment. For at least this reason, claims 26 and 49 are improperly rejected.

Moreover, claims 26 and 49 depend from claims 5 and 28, respectively, and are improperly rejected for reasons why claims 5 and 28 are improperly rejected.

2. Are claims 9, 10, 32, and 33 properly rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention?

Claim 9 recites "for an edit made to the movie composition, identify an interval of the element's corresponding timeline that may be affected by the edit." The Examiner contends that the term "may" or "may be" is indefinite, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The applicant respectfully submits that there is no indefiniteness as the interval that may be affected by an edit can be identified by identifying the interval that cannot be affected by an edit. The remainder of the element's timeline is the interval that may be affected by the edit. Thus, claim 9 is not indefinite and, accordingly, is

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improperly rejected. For the reason discussed above with respect to claim 9, claims 10, 32, and 33 are also improperly rejected.

Enclosed is a check for \$330 for the Appeal Brief Fee and a check for \$420 for the 2-Month Extension of Time Fee. Please apply any other appropriate charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

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Appendix of Claims

1. A computer program product, tangibly stored on a computer-readable medium, for calculating the validity of a cached frame of a movie in a movie compositing system, comprising instructions operable to cause a programmable processor to:

maintain a global editing timestamp that is updated with each editing operation performed by the system, the global editing timestamp representing an edit sequence position in a sequence of edits made to the movie;

establish an interval list for each node in a compositing tree defining a movie, each node having a timeline that maps to a master timeline of the movie, an interval list for a node including, for each interval in the node's timeline, a single editing timestamp;

update the interval list for a node when the node is edited; and

use the interval list for a first node to evaluate the validity of a cached frame for a particular interval of the master timeline, the cached frame having been produced by compositing the first node in the compositing tree, the evaluation being performed by (a) comparing (i) an editing timestamp associated with the cached frame with (ii) the editing timestamps of intervals in the interval list that map to at least a portion of the interval of the master timeline, and (b) treating the cached frame as invalid if any of the intervals' editing timestamps is later than the editing timestamp associated with the cached frame.

2. The product of claim 1, wherein the product further comprising instructions to:
use the interval lists of all nodes below the first node in the tree to evaluate the validity of the cached frame.

3. The product of claim 1, wherein:
updating the global timestamp comprises incrementing the global timestamp; and
the interval list is stored as a series of pairs (interval, timestamp), the series being sorted by the intervals.

4. The product of claim 3, wherein:
the series of (interval, timestamp) pairs are sorted in ascending order of intervals.

5. A computer program product, tangibly stored on a machine-readable medium, for displaying a frame of a movie composition, the product comprising instructions operable to cause a programmable processor to:

associate edit sequence information with an element of the movie composition, the edit sequence information specifying, for an interval of the element's timeline, an edit sequence position representing the position in a sequence of edits made to the movie composition of a most recent edit made that affects the element during the interval, the interval being a portion of the timeline;

when caching a frame, associate with the cached frame an edit sequence position that represents a state of editing of the movie composition; and

when displaying the frame, compare the edit sequence position associated with the cached frame with edit sequence information associated with the element.

6. The product of claim 5, wherein:
the edit sequence position that represents a state of editing of the movie composition includes the edit sequence position of a most recent edit made to the movie composition.

7. The product of claim 5, further comprising instructions to:
in response to an edit made to the movie composition, update the edit sequence information.

8. The product of claim 7, wherein:
the instructions to compare include instructions to compare the sequence position associated with the cached frame with the updated sequence information.

9. The product of claim 5, further comprising instructions to:
for an edit made to the movie composition, identify an interval of the element's
corresponding timeline that may be affected by the edit.
10. The product of claim 9, wherein:
the identified interval is the maximum range during which the edit may affect the
element.
11. The product of claim 5, further comprising instructions to:
for an edit made, identify an interval of the element's corresponding timeline that is
affected by the edit.
12. The product of claim 5, wherein instructions to compare include instructions to:
identify the edit sequence position of the most recent edit from the sequence information
associated with the element; and
compare the edit sequence position associated with the cached frame with the identified
edit sequence position.
13. The product of claim 5, wherein the sequence information associated with the
element is placed into groups, the product further comprising instructions to:
identify the most recent edit sequence information for each group.
14. The product of claim 5, wherein:
the edit sequence information includes an interval list, the interval list specifying, for
each interval of the element's timeline, the edit sequence position representing a position in a
sequence of edits made to the composition of a most recent edit made that affects the element
during the interval.

15. The product of claim 14, wherein:
each interval of the interval list includes a start time; and
except for the last listed interval of the interval list, each interval of the interval list is delimited by its start time and the start time of the subsequent interval.

16. The product of claim 15, wherein:
the movie composition has a master timeline to which the element's timeline maps, the master time line including a start time and a stop time;
the first interval listed in the element's interval list has a start time that precedes the start time of the composition's master timeline; and
the last interval listed in the element's interval list extends beyond the stop time of the composition's master timeline.

17. The product of claim 15, further comprising instructions to:
for an edit, determine the start time and duration of an interval when the edit may affect the element, and define new intervals in the interval list if the interval list does not include an interval having the start time and duration of the determined interval, the new intervals being defined based on the start time and the duration of the determined interval.

18. The product of claim 17, wherein:
the instructions to define new intervals include instructions to define new intervals such that the intervals in the interval list do not overlap.

19. The product of claim 17, further comprising:
associate the edit sequence position of the edit with the determined interval.

20. The product of claim 15, wherein:
the edit sequence position is represented by an integer.

21. The product of claim 20, wherein:

the interval list of an element includes a first array and a second array that is parallel to the first array, the first array including start times and the second array including integers representing edit sequence positions.

22. The product of claim 14, further comprising instructions to:

when displaying the frame, identify the interval of the interval list that affects the frame and compare the edit sequence position associated with the cached frame with the edit sequence position listed in the interval list for the identified interval.

23. The product of claim 14, further comprising instructions to:

maintain a first interval list for a first type of type of edits and a second interval list for a second type of edits.

24. The product of claim 23, further comprising instructions to:

in response to an edit to the composition, identify one or more interval lists to update; and update the identified interval lists.

25. The product of claim 5, wherein:

the element is a first element and the movie composition includes multiple elements; and the elements of the movie composition are nodes in a compositing tree, a parent node in the compositing tree being affected by changes to a child node in the compositing tree, the product further comprising instructions to:

when displaying the frame, identify one or more elements that are child nodes of the first element, the instructions to compare including instructions to compare the edit sequence position associated with the cached frame with the edit sequence information associated with the one or more elements identified as child nodes of the first element.

26. The product of claim 5, wherein:
the element is a first element and the movie composition includes multiple elements; and
the first element collaterally depends and one or more other elements in the movie composition, an element that is collaterally dependent on another element being affected by the other element, the product further comprising instructions to:

when displaying the frame, identify one or more elements on which the first element collaterally depends, the instructions to compare includes instructions to compare the edit sequence position associated with the cached frame to the edit sequence information associated with the one or more identified elements.

27. The product of claim 5, further comprising instructions to:
validate the cached frame when the edit sequence position associated with the cached frame specifies an edit that is as or more recent than an edit specified by the current edit sequence position specified recent as by the edit sequence information for the interval of the element's timeline.

28. A method for displaying a frame of a movie composition, the method comprising:
associating edit sequence information with an element of the movie composition, the edit sequence information specifying, for an interval of the element's timeline, an edit sequence position representing the position in a sequence of edits made to the movie composition of a most recent edit made that affects the element during the interval, the interval being a portion of the timeline;

when caching a frame, associating with the cached frame an edit sequence position that represents a state of editing of the movie composition; and

when displaying the frame, comparing the edit sequence position associated with the cached frame with edit sequence information associated with the element.

29. The method of claim 28, wherein:
the edit sequence position that represents a state of editing of the movie composition includes the edit sequence position of a most recent edit made to the movie composition.

30. The method of claim 28, further comprising:
in response to an edit made to the movie composition, updating the edit sequence information.

31. The method of claim 30, wherein:
the instructions to compare include instructions to compare the sequence position associated with the cached frame with the updated sequence information.

32. The method of claim 28, further comprising:
for an edit made to the movie composition, identifying an interval of the element's corresponding timeline that may be affected by the edit.

33. The method of claim 32, wherein:
the identified interval is the maximum range during which the edit may affect the element.

34. The method of claim 28, further comprising:
for an edit made, identifying an interval of the element's corresponding timeline that is affected by the edit.

35. The method of claim 28, wherein comparing includes:
identifying the edit sequence position of the most recent edit from the sequence information associated with the element; and
comparing the edit sequence position associated with the cached frame with the identified edit sequence position.

36. The method of claim 28, wherein the sequence information associated with the element is placed into groups, the method further comprising:
identifying the most recent edit sequence information for each group.

37. The method of claim 28, wherein:

the edit sequence information includes an interval list, the interval list specifying, for each interval of the element's timeline, the edit sequence position representing a position in a sequence of edits made to the composition of a most recent edit made that affects the element during the interval.

38. The method of claim 37, wherein:

each interval of the interval list includes a start time; and

except for the last listed interval of the interval list, each interval of the interval list is delimited by its start time and the start time of the subsequent interval.

39. The method of claim 38, wherein:

the movie composition has a master timeline to which the element's timeline maps, the master time line including a start time and a stop time;

the first interval listed in the element's interval list has a start time that precedes the start time of the composition's master timeline; and

the last interval listed in the element's interval list extends beyond the stop time of the composition's master timeline.

40. The method of claim 38, further comprising:

for an edit, determining the start time and duration of an interval when the edit may affect the element, and define new intervals in the interval list if the interval list does not include an interval having the start time and duration of the determined interval, the new intervals being defined based on the start time and the duration of the determined interval.

41. The method of claim 40, wherein:

defining new intervals include defining new intervals such that the intervals in the interval list do not overlap.

42. The method of claim 40, further comprising:
associating the edit sequence position of the edit with the determined interval.

43. The method of claim 38, wherein:
the edit sequence position is represented by an integer.

44. The method of claim 43, wherein:
the interval list of an element includes a first array and a second array that is parallel to
the first array, the first array including start times and the second array including integers
representing edit sequence positions.

45. The method of claim 37, further comprising:
when displaying the frame, identifying the interval of the interval list that affects the
frame and compare the edit sequence position associated with the cached frame with the edit
sequence position listed in the interval list for the identified interval.

46. The method of claim 37, further comprising:
maintaining a first interval list for a first type of type of edits and a second interval list for
a second type of edits.

47. The method of claim 46, further comprising:
in response to an edit to the composition, identifying one or more interval lists to update;
and
update the identified interval lists.

48. The method of claim 28, wherein:
the element is a first element and the movie composition includes multiple elements; and
the elements of the movie composition are nodes in a compositing tree, a parent node in the compositing tree being affected by changes to a child node in the compositing tree, the method further comprising:

when displaying the frame, identifying one or more elements that are child nodes of the first element, the step of comparing including comparing the edit sequence position associated with the cached frame with the edit sequence information associated with the one or more elements identified as child nodes of the first element.

49. The method of claim 28, wherein:
the element is a first element and the movie composition includes multiple elements; and
the first element collaterally depends and one or more other elements in the movie composition, an element that is collaterally dependent on another element being affected by the other element, the method further comprising:

when displaying the frame, identifying one or more elements on which the first element collaterally depends, the step of comparing includes comparing the edit sequence position associated with the cached frame to the edit sequence information associated with the one or more identified elements.

50. The method of claim 28, further comprising:
validating the cached frame when the edit sequence position associated with the cached frame specifies an edit that is as or more recent than an edit specified by the current edit sequence position specified recent as by the edit sequence information for the interval of the element's timeline.